MISSION OPERATIONS AND DATA SYSTEMS DIRECTORATE

Landsat-7 Image Assessment System (IAS) Interface Definitions Document (IDD)

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National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

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Prepared by:

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Concurred by:

Approved by:

Approved by:

Approved by:

Joy Henegar, Project Manager Date
Landsat 7 Image Assessment System, Code 514

Goddard Space Flight Center
Greenbelt, Maryland

Abstract

This Interface Definitions Document (IDD) presents the functional, performance, operational, and design requirements for the interfaces between the Landsat 7 Image Assessment System (IAS) subsystems.

This document provides a current understanding of the definition of the interfaces between the IAS subsystems. This interface definitions document will be baselined by the IAS during the IAS detailed design activities.

Keywords:*Interface Definitions Document (IDD), Landsat 7 Image Assessment System (IAS)*

Preface

This IDD is controlled by the Mission Operations and Systems Development Division (MOSDD) Configuration Control Board (CCB) and may be updated by Document Change Notice (DCN) or revision.

The interface definitions were prepared for:

Landsat 7 Processing System Project
Code 514.0
Goddard Space Flight Center
Greenbelt, MD 20771

1. INTRODUCTION

1.1 Purpose

This Interface Definitions Document (IDD) presents the interface requirements between the Landsat 7 Image Assessment System (IAS) subsystems located at the Earth Resources Observation System (EROS) Data Center (EDC). It will be an evolutionary document that will be updated as development progresses toward critical design.

1.2 Scope

This document provides the functional, performance, operational, and design requirements for the IAS subsystem interfaces. This document is intended for all parties requiring such information, including system engineers and system designers responsible for implementing the interfaces, and the system maintenance personnel responsible for maintaining the interfaces

1.3 Organization

This document is organized into 5 sections. Section 1 is the introduction to this document. The remaining sections are organized into four general categories.

The first category includes all Process Control Subsystem (PCS) interfaces. The PCS controls the management of the work order flow executed by the other five subsystems. These subsystems are the Data Management Subsystem (DMS), the Radiometric Processing Subsystem (RPS), the Geometric Processing Subsystem (GPS), the User Interface Subsystem (UI) and the Evaluation & Analysis (E&A) Subsystem. The subsystem interfaces are described in Section 2 through 5. The interfaces are identified to the level of completeness currently available to the designers.

1.4 Applicable Documents

1.4.1 Applicable Documents

The following documents provide the basis for developing the IAS subsystem interface definitions presented in this document.

1. Computer Sciences Corporation, *Landsat-7 Image Assessment System (IAS) System Design Specification,* December 1996.

2. National Aeronautics and Space Administration (NASA), Goddard Space Flight Center (GSFC), 430-15-01-001-0, *Landsat-7 Image Assessment System (IAS) Element Specification,* October 1996.

3. NASA/GSFC, 430-11-06-007-0, *Landsat 7 0R Distribution Product Data Format Control Book HDF Version*, July 2, 1996 Review Draft.

4. NASA/GSFC, 430-15-01-002-0, *Landsat 7 Calibration Parameter File Definition*.

5. NASA/GSFC, 430-L-0002-H, *Landsat 7 System Specification*, August 1994.

6. Computer Sciences Corporation, *Landsat-7 Mission Operations Center (MOC) to Image Assessment System (IAS) Interface Control Document (ICD)*, November, 1995.

7. NASA/GSFC, 514-1ICD/0195, *Interface Control Document (ICD) Between the Image Assessment System (IAS) and the Landsat-7 Processing System (LPS)*, January 31, 1996.

8. Hughes Information Technology Systems, 209-CD-013-003, *Interface Control Document Between EOSDIS Core System (ECS) and the Landsat 7 System*, March 1996.

1.4.2 Reference Documents

The following documents contain additional background information related to the Landsat-7 mission and to IAS.

1. NASA, *Landsat 7 Level 1 Requirements*, Draft Issue, August 8, 1994.

2. AlliedSignal Technical Services Corporation, *Landsat 7 Detailed Mission Requirements*, March 1996.

3. Martin Marietta Astro Space (MMAS), *Landsat-7 Image Assessment System Operations Concept*, September 1994.

4. NASA GSFC, 430-11-06--003-0, *Landsat 7 System and Operations Concept*, October 1994.

5. MMAS, CDRL No. A104, *Space Segment Calibration Plan*, August 1994.

6. MMAS, 23007702, *Landsat 7 System Data Format Control Book (DFCB) Volume 4 - Wideband Data*, December 2, 1994.

7. MMAS, CDRL #A058, 23007610A, *Landsat-7 Program Coordinate System Standard, Rev. B*, December 1994.

8. United States Geological Survey (USGS)/National Oceanic and Atmospheric Administration (NOAA), *Index to Landsat 7 Worldwide Reference System (WRS)*, 1982.

2. PCS and ALL IAS SUBSYSTEMS

This section describes all information transferred between the PCS and all other IAS subsystems. The PCS is responsible for starting, controlling, and monitoring IAS work order execution. In addition, PCS starts and monitors the DMS daemon tasks.

2.1 PCS and DMS

The DMS provides file ingest, resource monitoring, file deletion, and file transfer.

DMS ingests files from the MOCC and DAAC which are required as input to IAS work orders. DMS communicates the ingest status to PCS which triggers PCS to start work order execution.

Communications between the PCS and DMS is performed entirely through the database. PCS and DMS use global routines to connect to the database, commit/rollback database transactions, and disconnect from the database. PCS and DMS use stored procedures to read/write database data.

PCS starts DMS daemon tasks however no command line arguments are passed. As a child UNIX process, a DMS daemon task communicates its exit status to PCS.

2.1.1 Data_Avail_Notice

2.1.1.1 Description

The Data_Avail_Notice interface notifies the PCS that an L0R product or MOCC ephemeris file has arrived and is available for input to a work order.

2.1.1.2 Format

Table	Parameter	Type
L0R_Data_Catalog	L0R_FileName	Character String
L0R_Data_Catalog	L0R_IngestStatus (Pass/Fail)	Boolean Flag
L0R_Data_Catalog	L0R_SceneStartTime	Date
L0R_Data_Catalog	L0R_SceneStopTime	Date
Ephem_File	Ephem_FileName	Character String
Ephem_File	Ephem_FileType (Concentrated vs Definitive)	Character String
Ephem_File	Ephem_FileStartTime	Date
Ephem_File	Ephem_FileStopTime	Date

2.1.1.3 IPC Mechanism

The Data_Avail_Notice is passed from the DMS to PCS via the IAS database. PCS and DMS use global routines to connect to the database, commit database transactions,

and disconnect from the database. PCS and DMS use stored procedures to read/write the Data_Avail_Notice.

2.1.1.5 Frequency
DMS generates a Data_Avail_Notice for each L0R or ephemeris file received. IAS expects no more than 10 L0R products a day and 1 definitive ephemeris file per week and approximately 1 concentrated ephemeris file per week.

2.1.1.6 Sizing
The following table specifies the sizing for the Data_Avail_Notice. The numbers are based on Oracle RDBMS data type sizing:

Interface Element	Size (Bytes)
Data_Avail_Notice	**50**

2.1.2 Work Order Location

2.1.2.1 Description
The work order location interface notifies DMS of the directory location of the work order. PCS typically defines the default work order directory (although the user can also supply the directory) and writes its location to the database. DMS uses the work order location to delete/archive the work order.

2.1.2.2 Format

Table Name	Column Name	Data Type
Work Order	directory_name	char
Work order	work order id	char

2.1.2.4 IPC Mechanism
The work order location is passed from the DMS to PCS via the IAS database. PCS and DMS use global routines to connect to the database, commit database transactions, and disconnect from the database. PCS and DMS use stored procedures to read/write the work order location.

2.1.2.5 Frequency
Every IAS work order will have a default directory. IAS processes up to ten work orders a day.

2.1.2.6 Size
Each default work order directory will be stored in the DBMS in a 256 byte field.

2.2 PCS and RPS

The RPS provides radiometric correction of the L0R image. An RPS script starts each RPS program. PCS starts all RPS scripts as part of work order execution. As each RPS script terminates, the PCS retrieves the exit status and reports it to the IAS DB.

2.2.1 Proc_Parms

2.2.1.1 Description

The Proc_Parms interface contains processing parameters for radiometric calibration and generation of Level 1R image. PCS retrieves these parameter values from the IAS database and builds an ODL parameter file. PCS passes the ODL parameter filename to RPS during the fork/exec of the RPS script.

2.2.1.2 Format

Radiometric Characterization/Calibration

Scene ID		Specifies 1-3 WRS row long subinterval
bands	char 9x2	Bands to be processed (1,2,3,4,5,6L,6H,7,8)
Window coordinates		Specifies corner coordinates for processing less that a full scene
Scene type		Used by 1R programs to determine what algorithms to invoke (Day, Night, PASC, FASC)
Calibration Parameter File Name	char 256	Default - CPF bundled with L0R Product Option - user-specified custom CPF
Gain_Sources	char 15	Calibration Data Sources. For Gain, sources are: IC, PASC, FASC, CRaM, GLC, Prelaunch
Bias_Sources	char 15	Calibration Data Sources. For Bias Source: IC, PASC, Prelaunch
Apply Relative Gains	char 1	True/False
FASC_gain_angle		FASC Angles for Gain Calculation (min default = 68; max default = 75)
Fix_Dropped_Lines	char 1	Y/N; Substitute, Inline, Interpolate
Fix_Inoperable_Detectors	char 1	Y/N; Substitute, Inline, Interpolate
Fix_Saturated _Detectors	char 1	Y/N; Substitute, Inline, Interpolate
Sat_Bin_Thresh	long	Histogram Analysis Parameter: Saturation Bin Threshold (default = 1000)
Adj_Bin_Thresh		Histogram Analysis Parameter: Adjacent Bin Threshold (default = 10)
Adj_Bins_To_Test		Histogram Analysis Parameter: Adjacent Bins to test (default = 2)

Calibration_method	char 1	CPF Gains (default) or Internal Calibrator Gains
Map Projection		
SOM		defined by scene path
UTM_zone	long	zone number
UTM_base	long	Based on logitude by user must be able to force +/- one zone
LCC		
Latitude of First Standard Parallel		
Latitude of Second Standard Parallel		
Longitude of Central Meridian		
Latitude of Projection Origin		
False Easting		
False Northing		
TM		
Scale factor at Central Meridian		
Longitude of Central Meridian		
Latitude of projection origin		
OM_projection_type		
Scale Factor at Center of Projection		
Latitude of Projection Origin		
OM_A_1st_long		For OM Type A (Two-point description): Longitude of first point defining central geodetic line of projection
OM_A_1st_lat		For OM Type A: Latitude of first point defining central geodetic line of projection
OM_A_2nd_long		For OM Type A: Longitude of second point defining central geodetic line of projection
OM_A_2nd_lat		For OM Type A: Latitude of second point defining central geodetic line of projection
OM_B_Angle		For OM Type B (Azimuthal Description): Angle of azimuth east of north for central line of projection Longitude of point along central line of projection at which angle of azimuth is measured

Polyconic		
CM_longitude		Longitude of Central Meridian
Projection_Latitude		Latitude of projection origin
		Straight line vertical longitude from pole, either Standard Parallel or Scale factor at projection origin
Ellipsoid		Fixed as WGS84
Datum		Fixed as WGS84
reflective_band_pix_size	double	15.000-60.000 meters in increments of 0.001 meters (Default =3D 30.000)
Thermal_band_pix_size	double	15.000-60.000 meters in increments of 0.001 meters (Default =3D 2 x reflective band pixel size (60.000))
Pan_band_pix_size	double	15.000-60.000 meters in increments of 0.001 meters. (Default =3D 0.5 x reflective band pixel size (15.000))
Resampling_Option		CC, NN, MTFC
Output_Format		HDF, FAST, GeoTIFF

Parameter	**Type**
Characterize Random Noise	
Nr. of starting pixel	
Nr of swaths to process	
Nr of swaths to overlap (all integers)	
Table of ETM +SNR/NEDL spec	
Histogram analysis	
Number of scans in window to be used for calculation (default is 37 - one scene)	
Number of scans to overlap between windows (default is 36)	
Number of starting pixel (default is 1)	
Number of pixels for each calculation (default is normal scan length)	
Reference detector (one per band)	
Saturation bin threshold (default is 1000)	
Adjacent bin threshold (default is 10)	
Number of adjacent bin to test (default is 2)	
Process IC data	

Spectral emissivities of ETM+structural elements as known measured by SBRS	DN and/or real

Dropped Lines	
- Perform_Dropped_Line_Correction:	Logical
- Substitute/Interpolate:	Character
- Dropped_Line_Filled_Values:	Line of different length for different bands (1 per each detector of each band) the line length may also depend on data (?)
Detector Inoperability	
- Perform_Inoperable_Detector_Correction:	Logical
- Substitute/Interpolate:	Character
- Inoperable_Detector_Filled_Values:	Byte
	(1 per each detector of each band)
Detector Saturation	
- Perform_Detector_Saturation_Correction:	Logical
- Substitute/Interpolate:	Character
- Detector_Saturation_Filled_Values:	Byte (1 per each detector of each band)
Characterize Detector Operability	
Upper and Lower Limits of Saturation Spectral Radiance per band, low gain & high gain modes	Float
Characterize & Evaluate Relative and Absolute Radiometry	
Gain source (per detector or per band)	
Ratios	
Output Type (plot, table, both)	
Plot/table time scale (long or short term trends)	
Least squares trend fit	
Detector Gains	
Gain switch (non-default/biases)	
Gain correction	

Pre-launch gains and biases	
Default gain and bias source	
Radiometric correction per band	
DN to radiance conversion factors	
Radiance scale factor exponent	
Detector Temperature	
Reference gains and temps	
Temp sensitivity detector selection	

2.2.1.3 IPC Mechanism

All work order parameters as passed via an ODL file. PCS builds the ODL file and passes the ODL filename to RPS as a command line argument. RPS reads the ODL file via a global function. ODL is described in reference 999.

2.2.2 RPS Work Order Environment

2.2.2.1 Description

PCS is responsible for creating the environment in which RPS runs. This environment includes the directory structure, environment variables, standard out redirection, and command line arguments.

All RPS programs execute in a work order directory that contains two subdirectories: /temp and /save. The /temp directory is deleted and the /save directory is archived after E&A completes work order assessment. PCS builds the /temp and /save directories prior to work order execution.

PCS always defines an environment variable "xxx_work_order_id" prior to starting a work order. RPS calls several global routines to report status and trending data. These global routines access the "xxx_work_order_id" environment variable to determine whether the RPS program is being run inside PCS or in standalone mode. If PCS starts RPS, then all RPS status and trending data should be reported to the IAS database, but if RPS is run in standalone mode, then all RPS status and trending data should simply be written to ASCII files.

RPS programs will write all status messages to standard out. To capture these status messages in a log file, PCS creates a work order log file in the /save work order directory and redirects RPS standard out to this log file.

RPS programs expect a command line argument containing the filename of the file of input parameters. PCS supplies this filename as the only command line argument when starting an RPS script.. Within the RPS script, each RPS program is invoked with this input parameter filename as a command line argument.

2.2.2.2 Format

Parameter Type	**Parameter Name**	**Data Type**
Temporary directory	/temp	directory
Permanent directory	/save	directory
Environment variable	xxx_work_order_id	character string
RPS Standard Out	<work_order_id>.log	file
RPS program command line arg	argv[1]	character string

2.2.2.4 IPC Mechanism

A Unix process inherits the environment of its parent. The work order log file and xxx_work_order_id environment variable are both passed from PCS to RPS as part of the Unix environment. PCS passes the command line argument to RPS during the fork/exec of the RPS script. The /temp and /save directory names are expected to be hardcoded in RPS software, hence no IPC is needed.

2.2.2.5 Frequency

PCS builds the RPS work order environment for each work order processed. IAS expects approximately 10 work orders per day.

2.2.2.6 Size

The xxx_work_order_id environment variable will use approximately 25 bytes in the Unix process environment space.

2.2.3 RPS Completion Status

2.2.3.1 Description

PCS is the parent of all RPS scripts. When the RPS script exits, Unix returns the exit status to PCS.

2.2.3.2 Format

Parameter	Parameter Data Type
exit status	Integer

2.2.3.4 IPC Mechanism

Every child process in Unix (i.e. RPS) returns its exit status to its parent (i.e. PCS). The parent interprets the exit status via system calls.

2.2.3.5 Frequency

RPS Completion Status is return for every RPS script started by PCS.

2.2.3.6 Size

The exit status is returned in a four byte integer.

2.3 PCS and GPS

2.3.1 Proc_Parms

2.3.1.1 Description

The Proc_Parms interface contains processing parameters to perform 1G processing, geometric characterization and geometric calibration.

2.3.1.2 Format

TMINIT

input_image	char 256	Input image file name to be initialized
meta_opt	char 3	Option to validate the metadata (yes,no)
FDF_name	char 256	FDF ephemeris file name (option)

TMGRID

etm+_file_name	char 256	Input 1R or 0R image to generate grid for
tmodel_file_name	char 256	Input ETM+ model name
grid_file_name	char 256	Output grid file name
proj_code	long 1	Projection code
proj_zone	long 1	UTM zone code
proj_parms	double 15	Projection definition information
proj_units	char 12	Units the projection distances are in
pixel_size	double 3	Output pixel size: one value for bands 1-5 and 7, one value for band 6, and one value for band 8.
band_nums	long 9	Band numbers to process
frame_type	long 1	Framing Option
frame_coords	double 2x2	Frame coordinates that define the output space (either UL and LR corners, reference point and LR corner, or just UL corner depending on value of frame_type parameter)
coord_unit	char 12	Units of corner_coors (deg,min,sec,dms,pro)
lscoords	double 2	Line/sample coordinates (used when frame_type = 2)
nlines	long 3	Number of lines in output space (used when frame_type = 3) one value for bands 1-5 and 7, one

		value for band 6, and one value for band 8
nsamps	long 3	Number of samples in output space (used when frame_type = 3) one value for bands 1-5 and 7, one value for band 6, and one vlaue for band 8
path	long 1	WRS path number, Used for constructing standard path-oriented frame when frame_type = 5
row	double 1	WRS row number (may be fractional). Used for constructing standard path-oriented frame when frame_type = 5

TMRESAMPLE

input_1R_image	char 256	Input 1R or 0R image file name to be resampled
bands	long 9	Which bands to process
output_image	char 256	Output image file name
input_grid	char 256	Input grid file name
terrain_flag	long 1	Flag whether or not to apply terrain correction
in_dem_name	char 256	Input dem image file name (co-registered) (if terrain_flag = True)
terr_tbl_flag	long 1	Flag to read or calc table of terrain offsets (if terrain_flag = True)
terr_tbl_name	char 256	Name of optional input terrain table (elevation offsets file) (if terrain_flag = True)
delay_flag	long 1	Flag to apply detector delays
odtype	char 4	Output data type (byte,i*2,i*4,r*4,...)
ext_flag	long 1	Flag for saving the extended image
out_ext_name	char 256	Output extended image file name
window_flag	long 1	Window option (in,out)
window	long 4	Window (sl,ss,nl,ns)
resample	char 3	Resampling method (NN,CC,MTF,TABLE)
minmax_output_dn	float 2	Input resample weight table name
pccalpha	float 1	Parametric cubic convolution alpha parameter
backgrnd	float 1	Grey level fill value outside input image
trend_file	char 256	Scan gap statistics file name

CORRELATE

input_1G_image	char 256	Input systematic 1G image file name

measured_gcp	char 256	Output control point location results file
srch_win_size	long 2	Search window dimensions in lines and samples
path_wrs	long 1	Scene WRS path number for CGP library location
row_wrs	long 1	Scene WRS row number for CGP library location
abs_or_rel	char 3	Absolute (ABS) ground control or relative (REL) image to image tie point selection option
begin_date	long 2	Month and year before which to exclude GCP chip selection (may specify month only, year only, month and year, or zero for no GCP date exclusion)
end_date	long 2	Month and year after which to exclude GCP chip selection (may specify month only, year only, month and year, or zero for no GCP date exclusion)
season	char 4x6	Seasons from which to select GCP chips (winter, spring, summer, fall). NULL allows chips from all seasons.
chip_source	char 10x9	Image sources from which to select GCP chips
min_percent_succ	long 1	The minimum percentage of times a GCP has been successfully used to include for GCP chip selection. Zero includes all points

GCPLIBSTAT

in_residual	char 256	Input precision residual file name
path_wrs	long 1	Scene WRS path number for CGP library location
row_wrs	long 1	Scene WRS row number for GCP library location

TMPRECISION

input_1R_image	char 256	Input 1R or 0R image filename (used to get CPF)
input_1G_image	char 256	Input systematic 1G image file name
systematic_model	char 256	Input systematic ETM model file name
geo_grid	char 256	Input geometric grid file
measured_gcp	char 256	Input control point location results file
out_residual	char 256	Output residual file name
out_solution	char 256	Output precision solution file name
confidence_level	float 1	Outlier threshold confidence level (0.0-1.0)
gcp_outlier	char 256	GCP outlier tend/report file
parm_flg	char 7	Parameterization flag (att_orb,eph_yaw,both)

time_flg	char 3	Time rate estimation option (yes,no)
max_iter	long 1	Maximum iterations
att_apri	float 12	Attitude apriori means and standard deviations
eph_apri	float 12	Ephemeris apriori means and standard deviations
obs_apri	float 2	Observation apriori standard deviations

2.3.1.3 IPC Mechanism

All work order parameters as passed via an ODL file. PCS builds the ODL file and passes the ODL filename to GPS as a command line argument. GPS reads the ODL file via a global function. ODL is described in reference 999.

2.3.1.4 Frequency

The work order parameter file is build and passed to each work order script that executes. IAS expects approximately ten work orders a day with each work order containing approximately 10 scripts. Hence 100 work order parameter files will be generated each day.

2.3.1.5 Size

2.3.2 GPS Work Order Environment

PCS builds the same environment for both the GPS and RPS programs. See "RPS Work Order Environment" section for details of the GPS Work Order Environment.

2.3.3 GPS Processing Status

2.3.3.1 Description

PCS is the parent of all GPS scripts. When the GPS script exits, Unix returns the exit status to PCS.

2.3.3.2 Format

Parameter	Parameter Data Type
exit status	Integer

2.3.3.4 IPC Mechanism

Every child process in Unix returns its exit status to its parent. The parent interprets the exit status via system calls.

2.3.3.5 Frequency

GPS Completion Status is return for every GPS script started by PCS.

2.3.3.6 Size
The exit status is returned in a four byte integer.

2.4 PCS and E&A

2.4.1 Analyst_Notif

2.4.1.1 Description

The Analyst_Notif interface notifies the analyst when evaluation and analysis tasks are to be performed on the radiometric and geometric processing results.

2.4.1.2 Format

Table Name	Column Name	Type
Work_Order	work_order_id	char
Work_Order	work_order_state	char

2.4.1.3 IPC Mechanism

The Analyst_Notif is passed from the PCS to E&A via the IAS database. PCS and E&A use global routines to connect to the database, commit database transactions, and disconnect from the database. PCS and E&A use stored procedures to read/write the Analyst_Notif.

2.4.1.4 Frequency
An Analyst_Notif is generated for each work order. IAS expects ten work orders a day.

2.4.1.5 Size
The number of bytes to store the Analyst_Notif in the IAS database is approximately 15 bytes.

3. E&A and RPS, GPS and DMS

3.1 E&A and RPS

3.1.1 Char_Cal_Stats

3.1.1.1 Description

The Char_Cal_Stats interface contains trending data resulting from the radiometric calibration and characterization processes in creating the Level 1R image.

3.1.1.2 Format

Parameter	Type
Rad_Cal_Parms	
Rad_Char_Results	
Run_Log	
Detector Saturation	
Total number of High and Low saturated minor frames per detector for the scene	integers
Detector inoperability	
Noise level and dynamic range versus time	DN and/or real
Characterize Random noise	
Cal shutter data - standard deviations of each line (for each third, or whole scene) by detector in forward, direction reverse, and both	DN and/or real
- average standard deviations (scene or each third of the scene average of line standard deviations) by detector in forward reverse, and both directions	DN and/or real
FASC data - means (by detector and scan line)	DN and/or real
- means bias (by detector and scan line)	DN and/or real
- SNR (by detector and scan line)	DN and/or real
Night data - standard deviations of each line (for each third, or whole scene) by detector in forward, direction reverse, and both	DN and/or real
- average standard deviations (scene or each third of the scene average of line standard deviations) by detector in forward, reverse, and both directions	DN and/or real
Other scenes (ocean, snow, etc) - means (by detector and scene) - means bias (by detector and scene) - SNR (by detector and scene) - average standard deviations by detector	DN and/or real
Dark noise and night data as a function of time and temperature (DN and/or real?) Plots of NEDL vs L (DN and/or real?)	

Histogram analysis	
Detector gain ratios wrt. reference detector and average of all detectors - based on ratios of standard deviations	
- based on ratios of means after bias removal	DN and/or real
Bias offsets wtr. reference detector and average of all detectors	DN and/or real
Number of pixels including total used per detector, and number excluded on high and low end	
Standard deviations of reference detector and average of all detectors by band	DN and/or real
Gain ratios (based on both standard deviations and means) for forward and reverse scans	DN and/or real
Saturation bins - at 0Rc and 0R FFT magnitude (above background) at stripping related frequencies	DN and/or real
Process IC data	
Mean shutter values per scan, with standard deviations of sample space over the instrument life time and over a contiguous interval (within a single orbit)	
Integrated pulse values per scan	
Gains by scene, standard deviations and offsets by scan for each detector	
Uncertainties in gains, based on standard deviations of BB values	
Scene and Net offsets for each detector, for each gain state	
Uncertainties in offsets	
Noise levels of each reflective band detector (from Characterize Random noise functions)	
Fail and shutter flags, by line or by scene	
Lamp statistics - pulse height	

- pulse minima - pulse width - pulse location	
Shutter values	
Net pulse value and its standard deviation over the life time of the instrument and within a single orbit	
Instrument State trending - time since instrument was turned on - position in orbit - all recorded temperatures	
Characterize Memory effect	
Height and ratios of spectral peaks	
Characterize Detector Operability	
Detector operability mask (1 value per detector)	
Characterize & Evaluate Relative Radiometry & Absolute Radiometry	
Trend tables and plots per band	
Characterize Detector Temperature Sensitivity	
Temp sensitivity coefs**.**	

3.1.1.3 IPC Mechanism

The Char_Cal_Stats is passed from the RPS to E&A via the IAS database. RPS and E&A use global routines to connect to the database, commit database transactions, and disconnect from the database. RPS and E&A use stored procedures to read/write the Char_Cal_Stats.

3.1.1.4 Frequency

The Char_Cal_Stats is generated for each work order invoking RPS programs. IAS expects 10 work orders per day.

3.1.1.5 Size

The disk size estimates for storing trending data are contained in the IAS database design document.

3.1.2 Image_Data

3.1.2.1 Description

L0Rc image data created during radiometric artifact correction process.

3.1.2.2 Format

Lev_0Rc_Image	HDF

3.1.2.3 IPC Mechanism

The filename of the file containing the L0Rc image data will be hardcoded in the RPS, GPS, and E&A software.

3.1.2.4 Frequency
The image data can be generated during each work order execution. IAS expects to process ten work orders per day.

3.1.2.5 Sizing
The image data size is TBS.

3.2 E&A and GPS

3.2.1 Char_Cal _Stats

3.2.1.1 Description

The Char_Cal_Stats interface contains trending data resulting from the geometric calibration and characterization processes in creating the Level 1G image.

3.2.1.2 Format

Parameter	**Type**
Geo_Cal_Parms	
Geo_Char_Results	
Lev_1G_Image	
Run_Log	
PCD Temps	
ETM+ model	
Precision solution file	
Precision residuals	
GCP residuals	
GCP residual plot	
Visual Stats	
Poly residuals	
Poly coefs	
I2I residuals	
B2B residuals	
B2B stats	
Mirror scan stats	
Mirror profile coefs	

3.2.1.3 IPC Mechanism

The Char_Cal_Stats is passed from the GPS to E&A via the IAS database. GPS and E&A use global routines to connect to the database, commit database transactions, and disconnect from the database. GPS and E&A use stored procedures to read/write the Char_Cal_Stats.

3.1.1.4 Frequency
The Char_Cal_Stats is generated for each work order invoking GPS programs. IAS expects 10 work orders per day.

3.1.1.5 Size
The disk size estimates for storing trending data are contained in the IAS database design

3.2.2 Image_Data

3.2.2.1 Description

Lev_1G_Image created from geometric calibration and characterization processes.

3.2.2.2 Format

Lev_1G_Image	HDF

3.2.2.3 IPC Mechanism

The filename of the file containing the L0Rc image data will be hardcoded in the RPS, GPS, and E&A software.

3.1.2.4 Frequency
The image data can be generated during each work order execution. IAS expects to process ten work orders per day.

3.1.2.5 Sizing
The image data size is TBS

3.3 E&A and DMS

3.3.1 L0R_QC_Stats

3.3.1.1 Description

The L0R_QC_Stats interface provides trending statistics on PCD and MSCD Stats and image processing statistics.

3.3.1.2 Format

Parameter	**Type**
PCD Stats	

MSCD Stats	
Scan Gap Stats	
Telemetry Trending Stats	

3.3.1.3 IPC Mechanism

The L0R_QC_Stats is passed from the DMS to E&A via the IAS database. DMS and E&A use global routines to connect to the database, commit database transactions, and disconnect from the database. DMS and E&A use stored procedures to read/write the L0R_QC_Stats.

3.3.1.4 Frequency
The DMS generates L0R_QC_Stats for each L0R product ingested. IAS expects 10 L0R products a day.

3.3.1.5 Size
The disk size estimates for storing trending data are contained in the IAS database design

4. RPS and GPS

4.1 Lev_1R_Image

4.1.1.1 Description

Level 1R image generated by RPS calibration and characterization processing.

4.1.1.2 Format

Lev_1R_Image	

4.1.1.3 IPC Mechanism
The filename of the file containing the Lev_1R_Image data will be hardcoded in the RPS and GPS software.

4.1.2.4 Frequency
The image data can be generated during each work order execution. IAS expects to process ten work orders per day.

4.1.2.5 Sizing
The image data size is TBS

5. UI and PCS, DMS, and E&A

The IAS User Interface subsystem interfaces with other IAS subsystems via the database. The following subsections provide a high level description of each subsystem interface with the UI. A more detailed description of the contents of the

data flowing across the interfaces can be found in the structure chart data dictionary and the IAS database design specification.

5.1 UI and PCS

The following table lists the types of data passed between UI and PCS:

Name	Originator	Description
Work Order Setup	UI	work order script names, L0R filename, ephemeris file type, work order parameters, work order directory
IAS Configuration	UI	database polling intervals, directory names, maximum active work orders
IAS Directives	UI	shutdown IAS, restart an IAS daemon task
Work Order Monitoring	UI	User response to work order halt
Work Order Monitoring	PCS	Work order script completion status

5.2 UI and DMS

The following table lists the types of data passed between UI and DMS:

Name	Originator	Description
Work Order User Abort	UI	Informs DMS that work order can be deleted
MOCC file xfer request	UI	Request to transfer an ephem or scene request to MOCC
Generate Cal Parm File	UI	Request to generate the Cal Parm File
Data_Avail_Notice	DMS	Indicates an L0R or ephemeris file is on IAS disk
Cal Parm File xfer request	UI	Request DMS to transfer a Cal Parm File to external facilities
IAS configuration	UI	database polling intervals, directory names, disk usage thresholds

5.3 UI and E&A

The following table lists the types of data passed between UI and E&A:

Name	Originator	Description
Work Order Monitoring	E&A	Work order completion status
Work Order Setup	UI	work order parameters